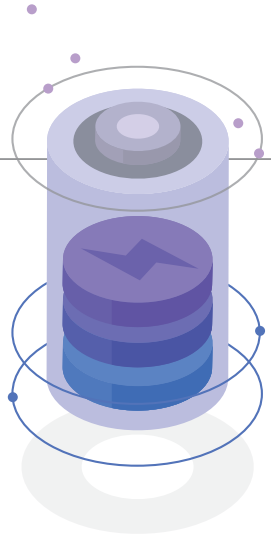
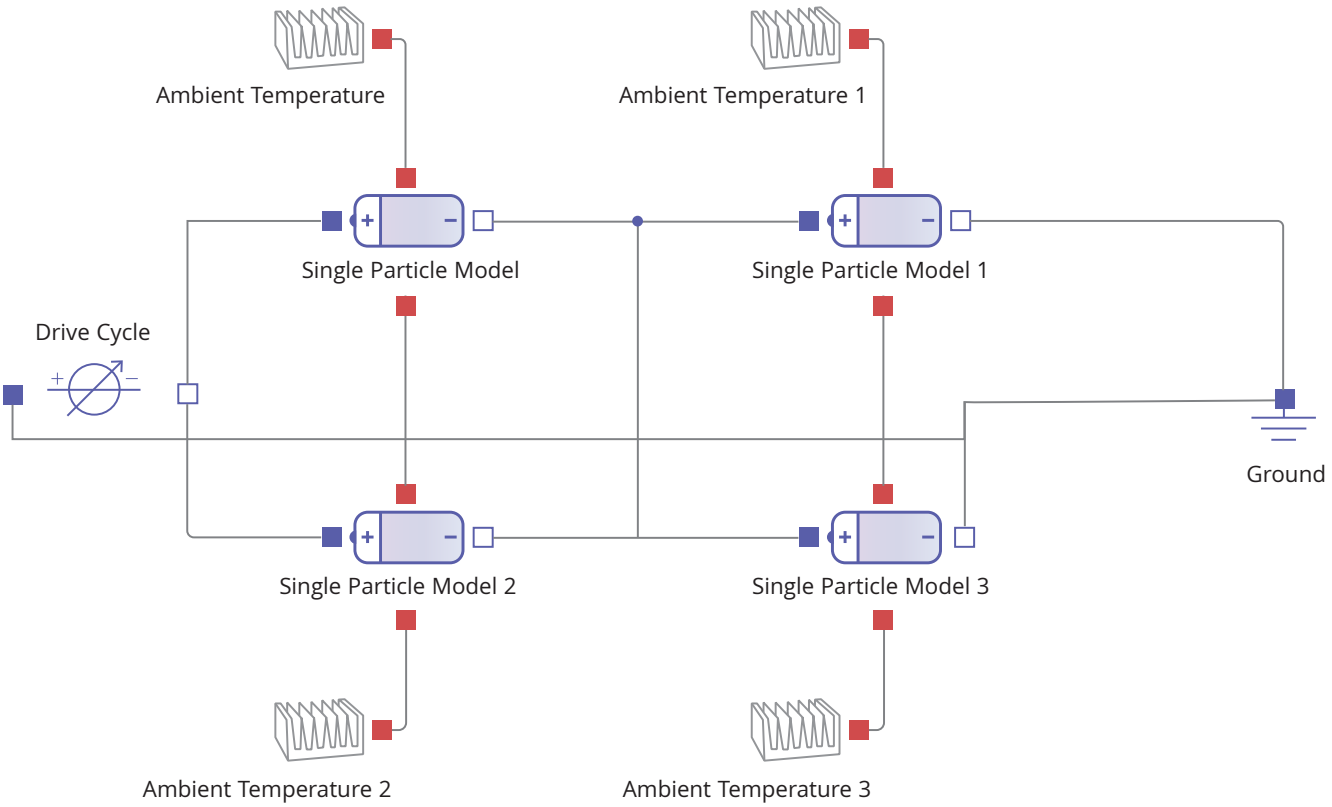
Julia SIM



JuliaSim Batteries Library

High-performance electrochemical lithium-ion battery simulations



JuliaSim Batteries is an advanced engineering tool for simulating lithium-ion batteries, integrating electrochemical, thermal, and degradation physics. Accurate battery models contain several coupled partial differential equations (PDEs) that are challenging to solve efficiently and robustly. JuliaSim Batteries brings your workflow to the next level with state-of-the-art differential equation solvers integrated with Scientific Machine Learning (SciML). Utilize the Doyle-Fuller-Newman model with 300 differential equations to predict battery lifetimes with fast charging 150,000x faster than real-time. Seamlessly scale your battery pack from a single cell to thousands of connected cells. Harness SciML to uncover hidden governing laws from data, such as degradation and low-temperature behavior.

Capabilities

Pack modeling

JuliaSim Batteries is performant and enables the predictive power of electrochemical models for large-scale battery packs.

Uncertainty quantification

Uncertainty is inherent in battery modeling. JuliaSimBatteries helps mitigate and understand the root causes of parametric uncertainty with JuliaSim Model Optimizer.

Fast charging

Built for robust and efficient simulations, even at the extreme operating conditions of fast-charge.

Degradation

Predict battery lifetime and health with SEI capacity fade models.

Discover hidden physics

Combine physics from our battery models and your data. Discover hidden governing laws using SciML tools.

Lifetime prediction

Estimate a battery's entire lifetime with fast charging in under a minute with the DFN model.

Model Library

JuliaSim Batteries offers several electrochemical models in cells, modules, and packs:

- **Doyle-Fuller-Newman Model (DFN):** High-fidelity simulation of a pseudo-2D lithium-ion battery model. Enables analysis and optimization of battery performance under various operating conditions.
- **Single-Particle Model with electrolyte (SPMe):** Simplifies the DFN battery model by considering a single particle for each electrode. Provides efficient simulations and valuable insights into cell-level behavior and degradation mechanisms in a fraction of the time of the DFN.
- **Single-Particle Model (SPM):** Perform rapid electrochemical simulations. The SPM model is effective for initial assessments, fast battery analysis, and large-scale pack simulations.